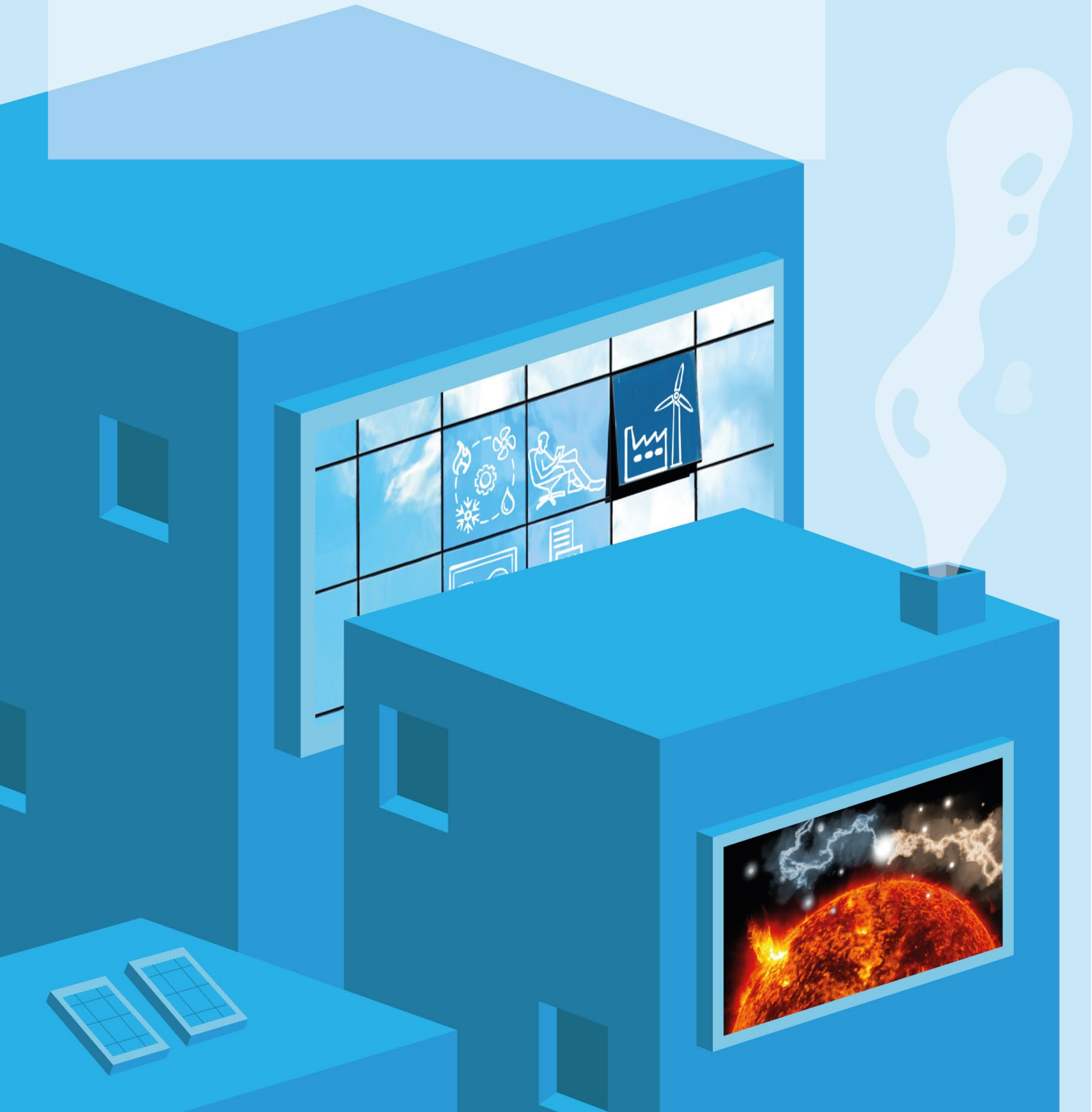
Energy Supply Systems for Buildings

Conversion Factors for units and separators



Conversion factors for units, prefixes and separators for decimals and thousands

Conventions for separators in this course

- Separators for decimals: '.' (point)
  Example: 32.6 means thirty two point 6
- Separators for thousands: thin space or no space
  Example: both 32600 and 32 600 mean thirty two thousand six hundred

SI Prefixes

Factor	Name	Symbol
10^{15}	peta	P
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{-3}	milli	m
10^{-6}	micro	µ
10^{-9}	nano	n

Units

Units: See for instance

-https://www.engineeringtoolbox.com/unit-converter-d_185.html

- Unit conversion factors (pdf) by E.J. Roschke and F.E.C. Culick, California Institute of Technology, 2001

(SI units: in bold underlines below)

Temperature:

Celsius [°C], fahrenheit [°F], **kelvin [K]**

- $T_K = T_{°C} + 273.15$
- $T_{°C} = T_K - 273.15$
- $T_{°C} = (T_{°F} - 32)/1.8$
- $T_{°F} = T_{°C}*1.8 + 32$
- $T_{°F} = (T_K - 273.15)*1.8 + 32$

Temperature difference:

- $\Delta T_{°C} = \Delta T_K = 1.8*\Delta T_{°F}$
- $\Delta T_{°F} = \Delta T_{°C}/1.8 = \Delta T_K/1.8$
- $\Delta T_K = \Delta T_{°C} = 1.8*\Delta T_{°F}$

In formula’s, K must be used for actual temperatures and K or C° is used for temperature differences (they are equal).

Length

foot [ft], inch [in], mile [mile] **metre [m]**

- 1 m = 3.28083 ft = 39.3701 in = $6.2137x10^{-4}$ mile
- 1 ft = 0.3048 m = 12 in = $1.894x10^{-4}$ mile
- 1 in = 0.0254 m = 0.08333 ft = $1.578x10^{-5}$ mile
- 1 mile = 1609.3 m = 63346 in = 5280 ft

Mass

ounce [oz], pound [lb], **kilogram [kg]**

- 1 kg = 2.2046 lb = 35.27 oz
- 1 lb = 16 oz = 0.4536 kg
- 1 oz = 28.35 $x10^{-3}$ kg = 0.0625 lb

Energy

british thermal unit [Btu] = [BTU], calorie [cal], kiloton oil equivalent [ktoe]**, watt hour [Wh], joule [J]**

- 1 Wh = $3.6x10^3$ J = 3600 J = = 859.9 cal = 3.412 Btu = $8.598x10^{-5}$ ktoe
- 1 J = $2.778x10^{-4}$ Wh = $0.2390x10^{-4}$ cal = $9.478x10^{-4}$ Btu = $2.388x10^{-17}$ ktoe
- 1 Btu = 251.996 cal = 0.29307 Wh = 1055.06 J = $2.52x10^{-11}$ ktoe
- 1 cal = 4.1868 J = $1.163x10^{-3}$ Wh = 3.968 $x10^{-3}$ Btu = 10-^{13} cal
- 1 ktoe = $11.63x10^9$ Wh = 41.868 $x10^{12}$ J = 10^{13} cal = 39 683. 2 $x10^6$ Btu

Energy flow rate
british thermal unit/hour [Btu/h], british thermal unit/second [Btu/s], calorie/hour [cal/h**], watt [W], joule/second [J]**

1 W = 1 J/s = 859.8 cal/h = 3.412 Btu/h =0.948 Btu/s

1 J/s = 1 W = 859.8 cal/h = 3.412 Btu/h =0.948 Btu/s

1 cal/h = 1.163×10^{-3} W = 1.163×10^{-3} J/s = 3.968×10^{-3} Btu/h = 1.102×10^{-3} Btu/s

1 Btu/s = 1055.1 W = 1055.1 J/s = 3600 Btu/h =0.07 cal/h

1 Btu/h = 0.2931 W = 0.2931 J/s = 252 cal/h = 2.778 10^{-4} Btu/s